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Systems Work In The Navy

The cleverest methodologist in the world is useless unless he can elicit information pertinent to the problem at hand.

E. D. Dwyer

▶ The management of today's Navy is a staggering job involving the direction of a huge industrial complex which is bigger than the ten largest private corporations combined. Problems which are common to corporate enterprises are found in magnified proportion in the Navy. An accelerated rate of expansion during and following World War II, a rapidly changing technology with new strategic concepts, rising costs, and stiffening competition from our competitors behind the Iron Curtain are just a few of the factors which are making our job increasingly difficult.

In this age of international tension, it is simply not enough to stockpile a bunch of H-bombs and then forget about defense. This type of "Maginot-line thinking" can be disastrous. We are confronted by a powerful adversary with a long-range goal of world domination and the conviction that time is on its side. The over-all strategy of the Russians appears to be one of continuous pressure towards the West on the economic, political, ideological, and military fronts with the belief that we will eventually crumble from within. One of the greatest challenges in this cold and occasionally hot war is on the economic front. Victory will not automatically go to the side with the biggest H-Bomb, but to the side which can support a cold war economy over the long run, while at the same time maintaining a rising standard of living for its people and a strong program of foreign aid for the underdeveloped nations of the world.

In this context, the problem of efficiency and economy takes on added significance. The notion is sometimes voiced that although efficiency and economy are valuable, the important thing is to get the job done and "hang" the cost. Nothing could be further from the truth. In terms of raw resources and raw power, neither side is able to demonstrate clear superiority. The real battle lies in the *utilization*

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and development of resources. The side which can utilize its resources so as to achieve maximum efficiency, economy, and effectiveness in the shortest time is the side which will eventually win the cold war.

For these reasons, the sound management of the business affairs of our military establishments is of paramount importance. An integral part of sound business administration is the development of *systems* which will achieve the utmost in economy, efficiency, and effectiveness. The body of this article is devoted to Navy's conception of systems work and the approach followed in the Navy Management Office.

The Systems Concept

"Systems" is an elusive concept that tends to shift its meaning between professions and among systems men as well. Systems analysis to an electronics engineer has a far different connotation than to an accountant or general manager. In a general sense, a system denotes a body of *related* methods, procedures, techniques, or equipments which are designed to bring about a given objective. Related means that each part of the system occurs in a definite sequence and is necessary to the accomplishment of the end objective. Also, the order or sequence is stable and exists over a period of time. If, over a period of time, we do not accomplish the same objective in the same way, we do not have a system; we have a trial-and-error procedure.

A good deal of the confusion over the term "systems" is due to differences in the purpose of a system. Systems can have a variety of objectives; however, there are two broad categories of systems which are differentiated by purpose. The first of these can be called a *technical system;* that is, one which is concerned with the manipulation of physical material. The plant layout of a shipyard, assembly line techniques, or the arrangement of components in a guided missile are examples of technical systems. The second major type of system is a *communication system.* Communication systems are concerned with the transmission of information within an organization. (*Information* is used here in its broadest sense as something communicated, including facts, directives, instructions, urgings, etc.) The methods and procedures which go into the production of a periodic report exemplify a communication system.

Technical systems support physical operations such as manufacturing and procurement. Communication systems support managerial functions such as planning, directing, and controlling. A communication system is a major tool of management which enables it to arrive at decisions and transmit them throughout an organization. Communications systems and technical systems cannot be neatly separated in actual practice, because managerial functions never exist in isolation. Managers do not plan, control, or direct per se. They plan, control, and direct the performance of technical operations. Similarly, communication systems do not support management in the abstract—they assist management in the performance of specific tasks.

Consider such a task as the construction of submarines. Men, money, materials, and facilities must be acquired and maintained; parts must be designed, manufactured, and assembled; goods must be transported and distributed. For all this to occur, however, someone must manage; that is, plan, direct, and control. The communication system which facilitates management gradually merges into the technical systems which are concerned with the actual work necessary to build the submarine.

To summarize the definition of a communication system:

1. Generally, any system is a body of related methods, procedures, techniques, or equipments existing in a definite order over a period of time.
2. Specifically, a communication system is:
   a. concerned with the transmittal of information within an organization.
   b. a major tool of management for the purpose of planning, directing, and controlling.

In this article, primary attention is being focused upon *communication systems,* although the Navy, of course, works with technical systems as well.

From the above definition of systems, it follows that a main problem of developing sound systems is a problem of communication. Management's need to receive pertinent information upon which to base decisions is obvious in effective communication. People must communicate this pertinent information to management in one way or another. Likewise, for management to translate a given policy into concrete action requires the coordination and cooperation of people. Management must communicate with operating people, and operating people must communicate among themselves in order to secure the necessary cooperative behavior which results in translating a policy into reality.

Systems men in government and industry are often thought of as "white collar" engineers. Just as industrial engineers are concerned with industrial methods, "white collar" engineers are concerned with office methods. This is, however, only partially correct. In our thinking, a systems man is not concerned with office methods and procedures in and of themselves, but with total communication systems. It just so happens that the great bulk of the methods and procedures which go into making up a communication system occur in offices and are commonly thought of as office methods. Communication systems, however, extend beyond the office and into the factory or other field activities. *A good systems man follows the system wherever it leads* and does not artificially restrict himself to the office or to white collar operations.

The Systems Approach

When we look at a system in this light, what we mean by the systems approach to organizational problems becomes clear. This approach, or analytical frame of reference, starts with a given objective or end result and observes the entire chain of communication which enters into the production of that result. Such an analysis takes us up and down the chain of command, it ranges laterally through several organizational components, and it often encompasses several recognized functions of the organization. Thus, when we look at an organization, we do not see it in terms of chains of command, formal departments, or abstract functions per se. We see an organization in terms of systems or communication processes organized about specific objectives. In addition to the actual process of communication, we also look at the incidental operations necessary to produce that communication.

The systems approach does not consider methods and procedures in isolation, nor does it view a system as the mere sum of individual methods and procedures. It has a structure of its own which is determined by the *general pattern* of indivdual methods and procedures. Patterns are not actually observable in the sense that a method or procedure is. When we observe methods and procedures, we see people

filling out forms, filing papers, keeping records, and writing reports. The pattern underlying this activity is an inference of what is taking place. Instead of describing surface behavior, we infer that information of a certain kind is being prepared and processed by certain people at a particular time and place for the purpose of guiding certain other people to reach decisions about a specific objective. In other words, when we are dealing with systems as a whole, we are concerned with *what* is communicated; to whom, when, where, and why. When we are dealing with the methods and procedures themselves, we are concerned with *how* it is communicated; that is, whether by forms, memoranda, punched cards, etc.

These two facets of the system approach are equally important. When we are developing sound systems, it is useless to recommend the ideal pattern the system should take unless we indicate the specific methods and procedures necessary to put that system into effect. Likewise, if we cannot see beyond our methods and procedures, we will be unable to integrate them into a sound system pattern.

The Systems Survey

What do we do when we undertake a systems survey? In a general sense, we employ the following systems approach. We try to look at the entire system in terms of an end result and at the processes of communication which must take place to secure that result. We do not attack methods and procedures by themselves and out of context of the system as a whole.

Defining the Objective. Our first step is to define the end objective which we are trying to realize. This is very difficult, and there are two major pitfalls awaiting the systems man in this initial step. The first is defining the objective too narrowly. This is easy to do because the first manifestations of a problem are often surface symptoms which can be easily mistaken for the real problem. For example, a given department may have been getting along very well over the years in processing certain papers. A recent increase in workload, however, has resulted in long delays. At first glance, the objective appears to be a streamlining of the department's methods and procedures so that it can once again get its work out on time, but to define the objective this narrowly would be a mistake. Why has the workload increased? What function does the department play in the total communication system? What sorts of information does it provide? Is this information necessary? Can it be provided better by someone else? Often, when an objective is defined too narrowly, the only result is that slow, unnecessary procedures are transformed into fast, unnecessary procedures.

The second major pitfall is defining the objective so broadly that the survey is doomed to failure before it even starts. For example, the objective of a given Bureau in the Navy is intimately related to the objectives of other Bureaus, to the entire Defense Department, to other governmental agencies, and ultimately, to the whole pattern of American and international politics. If we define our objective too broadly, the solution to the problem will be far beyond our resources. Politics has been defined as the art of the possible, and in this sense, the systems man must be a politician and concern himself with problems that have a reasonable expectation of solution.

Another point which must be observed in defining the objective is the problem of legal requirements. All governmental agencies, and corporations as well, operate within a network of rules and regulations promulgated by external bodies and not

open to easy modification. It is useless to spend time and money conducting a thorough systems survey if the basic structure of the system is fixed by law. This is not to say that we should have an uncritical reverence for laws and regulations. They frequently become out of date and need to be changed. If the objective is important enough, a strong effort should be made to change the rules. It may take a complete systems study to convince the external agencies of the desirability of modifying basic rules. This is always a calculated gamble, however, because too many other factors enter into the picture at this stage.

An intrinsic part of the objective is a working relationship between effectiveness, economy, and efficiency. I have been using these three terms without specifying their precise meanings other than indicating that they are desirable. *Effectiveness* refers to the characteristics of the end objective. If our objective is to make intelligent estimates of the personnel requirements of the Navy for five years hence, *effectiveness* will be determined by the accuracy of our ultimate prediction. The better we predict, the more effective we become. *Economy* refers to the cost of achieving the objective, and more specifically, to the lowest possible cost consistent with a given degree of effectiveness. *Efficiency,* as I am using the term, is actually a name for the optimum relationship between economy and effectiveness. That is, we are maximizing our results while minimizing our costs. Another way of expressing this is that in any system, the ratio between the value of the output and the value of the input is at a maximum when peak efficiency is achieved.

A private corporation, for example, is most efficient when it earns the most profit over the long haul (short-term profits are not always a gauge of management efficiency). Sometimes we actually spend more money to increase efficiency, providing the additional benefits finally achieved are greater than the additional cost. When considering any objective, the question of effectiveness, economy, and efficiency are all intimately interrelated and the systems man must juggle these three concepts and place them in their proper relationship.

In actual practice, top management of the Navy often specifies the degree of effectiveness and efficiency needed for the end objective. The problem for the systems man in this case is simply to design the most economical system. At other times, however, the only specification may be the cost. That is, we have a given amount of resources to accomplish an objective. The problem is to design the most effective system with the money we have.

To sum up our first step in a systems study, the systems analyst must define the basic objective without becoming diverted by peripheral symptoms or captivated with reforming the entire government. He must set objectives which have a reasonable chance of being realized through the means available to the level of authority with which he is dealing. And, he must have some idea as to the relationship between effectiveness, economy, and efficiency.

Gathering Facts. Once we have clearly defined our objective, the second step is to gather facts about the existing system and their effect upon the objective. Specific techniques of fact gathering, such as interview, questionnaire, and desk audits are not discussed here, for how we get the information is secondary to what we get. The cleverest methodologist in the world is useless unless he can elicit information pertinent to the problem at hand.

We are concerned with two things when we are gathering facts: First, with

the general pattern of the system; second, with specific methods and procedures. When we deal with the general pattern of a system, we try to determine *what* is communicated; *who* does the communicating; *when* they do it; *where* they do it; and *why?* We do not attempt to answer the *why* ourselves; we are interested in the explanations of the people who operate the system. Their justifications often give us clues to weak spots. For example, when we hear the familiar refrain "why, we've *always* done it that way!" we can be fairly certain that we have uncovered a weak spot.

We try to determine the detailed methods and procedures which constitute the system; in other words, *how* the system actually works. The *how* of a system spills over into many seemingly unrelated areas such as size of filing cabinets, different model typewriters, or computer installations. As a general rule we start with the substantitive information communicated and trace it back to its source, observing along the way the various forms the information has taken, the machinery and equipment involved, and the specific behavior of the people who process the data.

Analyzing Facts. Once we have defined our objective and gathered the facts, our third step is to analyze the facts. The purpose of the analysis is to develop causal relationships between components of the system and between the system as a whole and the end objective. In other words, we want to know the effect the system is having upon the objective and, more specifically, in what areas improvement is most needed.

The process of analysis can be broken into the following specific steps, although the steps may take place simultaneously in the thought processes of the human mind. These steps are:

1. Has identification of specific unsatisfactory conditions been made? In other words, where in the system do bottlenecks occur, where is the error rate high, where is the cost excessive, and where is there dissatisfaction over the information produced? Where are wrong decisions made due to inaccurate or incomplete information?

2. Once we have identified the weak spots of the system, our second step is to relate them to their underlying causes. In effect, this is simply differentiating the real problem from surface symptoms. For example, a particular office may continually fall behind in its workload. Is the problem simply to make people work faster or is it a manifestation of deeper problems? Perhaps the office is required to separate certain pertinent information from a mass of raw data communicated from the field. The real problem may be *how* to communicate only pertinent information from the field.

3. The third step in the analysis phase is to determine the interrelationships between the specific unsatisfactory conditions. For example, perhaps the large backlog of work in Office *A* is responsible for a high rate of error in Office *B* and excessive costs in Office *C*. When unsatisfactory conditions are interdependent, a few changes may have considerable effect. Of course, if the unsatisfactory conditions and their root causes appear to be independent, they will have to be attacked separately.

Making Recommendations. We have now defined our objective, gathered facts, and analyzed them. Our fourth major step is to develop a new system. Before this can be done, however, it may be necessary to re-define the major objective. Our analysis may reveal that we have defined our objective too narrowly and that the defects in a system are inherent because

of the characteristics of a larger system of which it is a part. If this is the case, we must expand the scope of our survey and repeat the same process of defining the objective, gathering facts, and analyzing these facts. Conversely, we may discover that we have defined our objective too broadly and find ourselves attacking conditions which are not open to ready modification. They may be fixed by law or by regulations from external agencies, top management may be unwilling to make extensive changes at this level, or someone else at a higher level may be working on it. Whatever the reasons, we must restrict the scope of the survey and concentrate upon the more detailed aspects of the system.

What. Assume that we were successful in defining our objective within the appropriate range. We are now ready to devise a new system. This is done by concentrating upon the problem areas we have isolated and by developing solutions. Our first step is to concentrate on *what* should be communicated. A good many systems are inadequate, not so much because of faulty procedures, but because they are not providing pertinent information. The determination of what should be communicated is largely a matter of common sense; there are no hard and fast rules. We consider this problem in the light of the end objective and project ourselves into the position of those who receive the information and act upon it. When we complete this first step, we can recommend the *elimination* of unnecessary information or the production of different kinds of information, or both. Or sometimes, the problem may merely be the manipulation and refinement of data already known. For example, Navy is currently working on a system which will develop information that will serve as a basis for awarding jet fuel contracts. All the pertinent information is readily available; however, it exists in unmanageable proportions. There may be as many as 270 bids submitted for the requirements of 280 air bases and stations. There are literally millions of possible combinations or ways of awarding the contracts and this wide range of alternatives is too great for the human mind to juggle, weigh, and decide upon. Through the use of "operations research," we are constructing a mathematical formula which will provide the lowest cost allocation of contracts considering all the factors of purchase price, transportation costs, geographic location, etc. Through this technique, Navy hopes to manipulate information already known into a more meaningful form so as to improve the decisions being made. When we recommend the production of different kinds of information or the manipulation of existing information, we must consider the cost involved and decide whether the increased benefits warrant the additional cost. Another aspect to the determination of what should be communicated is the question of the degree of accuracy. How accurate does the information need to be in order to accomplish the objective? This again is a cost question. If the cost of eliminating errors is greater than the benefits realized by the increased accuracy, it is clearly prudent to settle for an optimum rate of error where the cost of eliminating balances the additional benefits.

To Whom. Our second step is to determine *to whom* the information should be communicated. This gets into the whole area of organization analysis and many of the principles substantiated therein are directly applicable. For example, we become concerned with the question of centralization versus decentralization. Is all the information being communicated to a top few who are unable to digest and handle it? Or does all the communication take place at lower

levels without adequate control by top management? Likewise, we are concerned with the division of functional responsibilities. Does the information go to the right department for action, or is someone else better equipped to handle it? I do not wish to go into all the fine points of organization analysis since that would be an article in itself. I merely want to indicate that we do get into the field and that we consider organization analysis a major aspect of a systems survey.

When. Our third step is to determine *when* communication should take place. Can any improvements be noted by merely changing the *order* in which categories of information are communicated. We also try to determine the relationship between speed of communication efficiency and end effectiveness. Can we achieve significant benefits by increasing the speed with which we communicate information or would this result in a marginal benefit only? Similarly, we have to look at the increased cost entailed in speeding up communication and decide whether it would be justified by the increase in effectiveness.

Where. Our fourth step is to determine *where* the communication should take place. This involves the spatial positioning of communication points. Techniques of operations research have proven very successful in solving complex problems of this type. On a simpler scale—within a building or even in a small office where the only problem is the arrangement of the desks—techniques of office layout have proven useful.

Often the question of *where*, in terms of space, is related to the question of *who* in terms of organizational level. For example, from a pure organizational point of view, it may be desirable to route a communication to Office *A*. From a space standpoint, however, Office *B* may be in a more favorable position because of its physical proximity. In this case, the advantages of logical organization must be weighed against physical convenience.

How. Our fifth and final step in developing a new system is determining *how* the communication should take place once we have settled upon the *what*, *who*, *when*, and *where*. This is the "nuts and bolts" aspect of the survey and often the major part. There are a wide variety of techniques which we use in this connection:

1. *Forms Management:* Can processes be streamlined by eliminating, consolidating, or standardizing forms? Can new forms be introduced which will simplify the procedure?

2. *Reports Management:* Can reporting systems and patterns be streamlined? Can reports be combined or eliminated if the information is available somewhere else? Can the reporting instructions be clarified? Can the frequency be reduced? Is the reported information worth the cost?

3. *Directives Management:* Do we have a logical system for communicating policies and procedures? Can directives be identified and located when needed? Are there automatic procedures for maintaining currentness? Are they distributed on a "need-to-know" basis? Does the system bring together related policies and procedures?

4. *Correspondence Management:* Are our letters simple, short, sincere, and strong? Are we taking advantage of form letters and pattern paragraphs? Are we using shortcuts such as stamped endorsements?

5. *Records Management:* Do filing systems facilitate the location of information? Are they worth the cost? Are there automatic procedures for screening and disposing of obsolete records?

6. *Statistical Techniques:* Is management supported, aided by work measurement, performance standards, quality control, and production control?

7. *Mechnization:* Can manual methods be mechanized? Can information systems be integrated? Can raw data be captured at their source on "common language" tape or cards? Can a small scale information system tie into an electronic computer installation? Is existing mechanization uneconomical; would manual methods be preferable?

Management is turning with great interest to the possibilities of automated data processing and a good deal of systems work consists in considering these possibilities. Like all new ideas, however, there is a tendency for enthusiastic proponents to oversell the concept and to present it as a universal panacea to management problems.

I believe that one of the great benefits of the "office automation" movement, and one which is often underscored in professional literature, is the advantage realized through a thorough systems study of an operation. No one wants to spend huge sums of money for expensive automatic data processing equipment, and it is not too difficult to convince responsible officials of the need for a thorough systems study *prior* to investing in this type of equipment. Regardless of whether the study results in automatic data processing, a systems study is often of great value because it forces a searching and critical examination of the existing system. Many incidental improvements are made as a by-product of the study, even though they were not the primary object in the first place. As an example, Navy recently conducted a systems study of one of its purchasing activities with a view towards installing automated office equipment. Before the question of automatic equipment was even considered, the study revealed many procedures which were obsolete or unnecessary, and as a result, an entire office was abolished, two levels of review eliminated, the work flow was rerouted and streamlined, written forms were revised and combined, and several forms were eliminated entirely.

Large-scale computer feasibility studies have the same intrinsic value regardless of whether they result in the installation of an actual computer. Government, like business, operates in a dynamic and rapidly changing environment. Systems and procedures can become obsolete overnight unless adjustments are constantly made to keep up with changing developments. This is why I believe the office automation movement has been the biggest boon to systems men in the Navy and elsewhere. It has afforded them an opportunity to conduct systems studies in many areas which have grown stagnant over the years.

Conclusion

To sum up, I have tried to indicate our concept of "systems," what we mean by the systems approach, and how we conduct a systems study. It probably goes without saying that there is no such thing as a perfect system. A system, like a human personality, is a product of historical evolution and is influenced by many uncontrollable factors. We cannot change a system overnight, and we must always compromise the ideal system with hard reality. I prefer to think of systems work as a dynamic profession in which we are constantly working for and moving toward an ideal system which always manages to stay a few steps ahead of us. This is what makes systems work sometimes rewarding, sometimes frustrating, but always extremely challenging. s/p/a

"Are you polishing brass on a sinking ship?"

The Feasibility Study For Office Automation

R. Hunt Brown

▶ There are two basic and well-established approaches to the problem of deciding how to conduct the feasibility study for the automation of an office. First, after a brief period of review and discussion, management states, "We will place orders for such and such a computer system and for integrated data processing equipment for the pre-computer area and decide how to use it while waiting for delivery." The second approach is to make a decision *after* a detailed systems analysis of the company's present methods. Either of the two methods involves a detailed feasibility study, whether effected before or after ordering.

The first approach is largely a top-level unilateral executive decision. It is usually made after a preliminary systems survey by company personnel or after some discussions with manufacturers' representatives, and a study of their submitted proposals. Top management looks over the equipment, makes a selection, and places an order or writes a letter of intent. It is important to realize, however, that in the first or "short-cut" approach, a detailed systems and procedures analysis must *follow* the unilateral decision before the equipment can be used properly.

There are generally two reasons for by-passing the feasibility study before ordering the equipment: economy and time. A feasibility study generally takes a number of people several months, sometimes many man-years. When top management believes that it needs automated equipment and that there should be no delay in getting this valuable tool, time

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of application is reduced, but there is the risk that such high-handed decisions are afterwards regretted. This has happened in more than one company.

The Investigation Team

Once it has been decided to undertake a feasibility study, either before or after orders are placed, the first problem is to decide which persons will make it. It is almost axiomatic that the study group should include those who have some background in technical knowledge of the new techniques and machines, besides accounting and systems and procedures personnel. Therefore, individuals on the following levels, at least, should be on the feasibility study team:

1. An executive officer of the company, to coordinate the project.
2. A consultant (either on a temporary or full-time basis), who knows what the new machines can do.
3. The controller or an assistant controller to supply the accounting background.
4. The systems and procedures director who is familiar with methods employed.
5. The manager of the tabulating department, who knows what end results are needed in the way of reports, etc., if punched cards are being used.
6. Other qualified personnel such as department heads concerned.

It is essential that the group should be headed by someone with authority to make decisions, at least on the vice-presidential level.

Use of Consultants

Many companies find it difficult to release such a group for full-time devotion to the feasibility study assignment, and this is one job which cannot be done on a part-time basis. When this is the case, the company should call in a consultant experienced in automating that particular branch of activity. A qualified consultant can, if necessary, conduct the entire feasibility study from start to finish with the aid of his associates but, of course, in cooperation with the company's personnel involved.

A feasibility study includes a review of corporate operations on all levels. The consultant and his associates make a systems analysis, evaluate equipment, prepare cost comparisons, and blueprint the contemplated installation procedure.

Another (and more usual) manner in which a qualified consultant can be used is as an advisor to a company study group. In this way, the feasibility committee does the work of fact-gathering and systems analysis, at a lower over-all cost. The consultant contributes his specialized knowledge of data processing systems and "hardware" to help evaluate the equipment selection for planning the installation. This combination of efforts usually produces the fastest and most economical feasibility approach.

The Systems Survey

The first step in making a systems survey is to determine which application areas are to be covered by the survey team. Often, these are selected or determined by top management. The normal reaction by management is to review the so-called "bread and butter" data processing areas where the greatest number of clerical operations are found. These applications are usually concerned with customer relations (orders, invoices, accounts receivable, statistics, etc.), employee relations (payroll and personnel

records), inventory and production control, and cost accounting. However, these are sometimes interrelated and often provide the basis for scientific management activities as well. Thus operations research and the new automatic decision-making techniques may well prove to be important areas for review.

After the application areas are selected, the study group gathers facts in each area. All forms are collected and reviewed. Process or flow charts of existing methods are developed or brought up-to-date. If there is a procedures manual, it should be checked to make sure that it is current. Reports now being prepared are studied. Wherever data cross departmental lines, they should be carefully followed to their end use. Every clerical operation being performed should be studied and noted, including each inspection and supervisory activity. The flow of information should be traced carefully from point-of-origin to point-of-decision, including management reports. In brief, it is necessary to know what comes in the door and what goes out.

These facts must be graphically drawn into chart form and verified. Flow charts assist in indicating areas of duplication for consequent improvement. Man-hours, machines, forms, and operational costs should be noted on charts for all clerical operations. The following questions should be asked:

1. Can any forms, reports, and other procedures be *eliminated? simplified?*
2. Can certain operations be *combined* with other operations?
3. Can the sequence of steps of a procedure be improved?
4. What is the minimum of information needed for management decisions?
5. What reports desired by management are not now available?

The study group should determine at each operational step the quantity and quality of inspection needed for performance results; also, the quality and amount of supervision required. Company policy and practices at each stage should be scrutinized for current and future want rather than for past habit or use. Reports should be thoroughly explored as to purpose, use, practicability, need, cost, accomplished results, and duplication of data. Forms should be examined as to their design, distribution of copies, filing and handling, and cost of preparation.

The survey group must continually probe for facts beneath the surface by posing five fundamental questions: how? why? what? when? and where? to each phase of the application area including the role of administration in the work load.

Next, a systems process can be instituted. What is needed in an electronic or integrated data processing system can be determined. Systems and procedure improvements, which will result in immediate cost reductions, can often be made at once without waiting for the new system to be introduced. Indeed, there is considerable evidence which bears out the claim that in due time the results of a thorough feasibility study pay for the cost of a data processing equipment installation. A study at least pays off in uncovering obsolete methods even if nothing is done about new systems equipment at the time, no matter how well organized a business may consider itself to be.

Information can now be separated into two parts: data going into the system (input), and data coming out of the system (output). Input information

should then be examined for the following points:

1. Where does it originate—internally or externally?
2. How is it communicated—orally, by teleprinter, document, or messenger?
3. What legal and auditing requirements must it satisfy?
4. What machine is used to originate it?

Output information should next be inspected for the following:

1. Who needs the information?
2. Why is it needed?
3. In what form is it needed?
4. When is it needed?
5. How is it used?
6. What are the decisions caused by the information?
7. When and by whom should they be made?
8. What other factors are used to make the decisions?

Four other basic questions that should be considered are:

1. What is the status of the input data? Is it in raw form or can it be in a by-product form for automatic computer processing?
2. How are the input data to be transformed by programming into information required by management?
3. What output data are needed by management? In what form must they be presented to improve decision-making?
4. How is the system to be installed without excessive costs or difficult transitional problems?

In developing the ideal system, the feasibility team must view the entire application area in terms of process flow, needs, and objectives. *A view of the forest ought to be made without paying too much attention to the trees. Otherwise, one may be polishing brass on a sinking ship.* The specific steps in present procedures must be temporarily forgotten, because office automation is not a speeding up of steps in existing procedures. Its goal is to develop more efficient and probably entirely different over-all systems of handling data. In the end result, entire departments may be eliminated, perhaps new ones created to take their place, and others may be merged.

The systems survey and analysis technique should be applied to each information handling area. When this has been done, it is possible for the study team to draw up a set of requirements that a company-wide data processing system must meet. These requirements can then be developed into a set of equipment specifications which may be used to select the new system.

Reviewing Available Equipment

With a complete knowledge of system requirements, it is now time to review existing data processing equipment. Manufacturers of equipment normally maintain showroom or service bureau facilities where it is possible to see equipment demonstrations. However, as a result of the high unit cost of tape punching equipment, communication devices, and electronic computers, the opportunity to see the equipment in action is generally restricted to a few large cities. It may be possible to inspect a working installation in some nearby company; the machine manufacturer can advise one in this respect. When reviewing equipment, one should learn as much as possible about it before consulting the manufacturers, so as not to become too involved in a system unlikely to be chosen.

A general statement of data processing requirements should be prepared indicating the application areas, a listing of

items involved, type of records maintained, and other related data. It should be submitted to each manufacturer having the type of equipment needed. The manufacturers should be informed that there is a desire to see the equipment in operation.

Prior to a demonstration, check lists of equipment features should be prepared to include capacities, speeds, maintenance factors, training, ease of operation, programming, and other related elements. This is an excellent way to record information for further evaluation, as it helps to eliminate the chaff of sales talk and to get at the wheat of vital facts. In addition to the above, if electronic computers are being considered, the study group should attend manufacturers' orientation and training sessions. Seminars are also offered by trade associations, universities, and a few consulting groups.

The feasibility committee must next proceed to evaluate the costs of present versus proposed systems, to decide between a centralized or decentralized data processing installation, and whether to rent or purchase equipment.

Cost Considerations

Many executives believe that only tangible savings are a significant criterion; that cost justification must be real, not imaginative. Improved service to customers is very important. Getting financial reports out three to five days ahead of time is an advantage that is difficult to price, but it *can* be done with some degree of accuracy. Savings resulting from the elimination of voluminous forms by "exception reporting" are also difficult to estimate. Most companies want to "pay" for their new systems installation within four to five years, which is the period on which amortization is usually based.

Will an office automation installation pay off? Estimating the tangible and intangible cost savings of an electronic or integrated data processing system is a complex, analytical task. During the preliminary survey, improvements of present procedures should be indicated. Are they, for example, to be considered as part of the cost comparison?

Calculating the Cost of Office Automation

The factors to be considered in calculating the cost of a data processing installation include:

1. *Non-Recurring Costs*
   - (a) Feasibility study
   - (b) Block diagramming of present procedures
   - (c) Initial programming for each application
   - (d) Operator and service technician training
   - (e) Test checking the programs
   - (f) Costs due to lowered efficiency at start of new system
   - (g) Rewiring for power supply and air conditioning equipment
   - (h) Remodeling of building space, or the building of new or additional space
   - (i) Record change-over from present forms (unit documents or punched cards, etc.) to new data form (punched tape, magnetic tape, etc.)
   - (j) Parallel operation during change-over for "debugging"
2. *Recurring Costs*
   - (a) Rental per annum, or purchase price amortized over expected life of each new unit of equipment, including all communications equipment not presently used, but which is usually rented

(b) Training program for personnel, though greatly reduced after the original installation, will be a continuing expense
(c) Operating personnel costs
(d) Equipment maintenance costs
(e) Insurance charges on equipment
(f) Floor space charges
(g) Printed form costs

These calculations should be made for at least two competitive data processing systems.

Centralization versus Decentralization

Office automation systems are developed to handle masses of data. Often, as a result of the high cost of installing and planning such a system, it is necessary to bring all related accounting activities for a specific data processing application, such as payroll, into a centralized location. The two opposing philosophies of centralization versus decentralization call for a review of the *pros* and *cons* of the problem.

A centralized data processing system enables a centralized management to make faster top-level decisions about finance, inventory, marketing, and production. It permits a closer watch over the handling of data. It simplifies the execution of management decisions into specific assignments and aids in examining performance. It assists in flexible managerial control, allowing top management to call for various special reports and analyses as they are needed. Through communication systems, centralized processing services easily supply local managements with data needed for their operations. As a result, line managers can ask for special reports which might not be available to them if they had their own smaller data processing departments.

One large centralized data processing operation results in economy since both initial installation expenditures and operating costs are less than for several smaller installations. Where an electronic computer is involved, a centralized operation will permit a smooth functioning of branch office data processing as well as home office accounting and analytical functions. Computer time may also be available for other activities such as operations research. "Empire builders" may try to increase the size of decentralized operations, sometimes to the detriment of the company's interests.

On the other hand, a decentralized data processing system keeps accounting and analytical operations close at hand where they are needed. It reduces communications cost between branch and home offices. Where a large centralized operation normally requires careful scheduling for branch data processing, decentralized operations avoid problems of over-all scheduling and provide line management with maximum flexibility. Indeed, decentralization permits prompt action by local managers when the information coming out of their own offices calls for it.

These various *pros* and *cons* can be used by each organization to make a decision about an office automation system. Many integrated data processing systems can be organized on either a decentralized or centralized basis without material advantages or disadvantages. When an electronic computer system is involved, however, its need ought to be carefully considered. Here again, the present availability of small-size and low-cost computers makes a decision easier regarding centralized or decentralized centers. Formerly, when only large computers were available, the decisions were generally for centralized operations. The

optimum solution may be to retain decentralized management and to have a centralized computer like Sylvania Electric, for instance.

Report to Management

The summary of findings of the feasibility study which is prepared for management's appraisal ought to be based upon three major considerations:

1. Description of applications selected for study, reasons for their selection, and problems involved in solution.

2. Analysis of cost comparisons.

   (a) The estimate of tangible savings by reduction of clerical costs and such overhead factors as space, etc.

   (b) Approximations of intangible benefits such as improved accuracy, faster and better reports, etc.

3. Recommendations for or against a new data processing system should include reasons for them. If the recommendation is in favor of a new system, equipment preference should be stated, including reasons for preference. A report may conclude with recommendations for more study or to call in a consultant for an equipment evaluation. If the recommendation is against the present acquisition of a new system, the reasons should be detailed.

Final Selection of Equipment

If a decision has been made to adopt a new office automation system, there is still the problem of which machines to use. Decisions have to be made about what to buy or rent. For many of these problems there are no universal answers or rules of thumb. Advice and information can be secured from others who have faced similar problems and who have solved them, or from an independent consulting engineer.

Testing the System

Pretesting any system is one way of determining whether it will work. In any revolutionary data handling procedure there are unforeseen problems that arise to plague an organization. It is desirable, therefore, to experiment beforehand as much as possible. Integrated data processing systems using punched tape equipment can be tried out at manufacturers having IDP centers, such as Standard Register, Friden, and Uarco. Western Union and some local telephone companies also have IDP workshops. Business machine companies, of course, also permit the use of their equipment for trial applications. There are also various service bureaus available where customers can pre-test electronic computer applications.

It is recommended that at least two types of data processing system equipment be tested for application by a company. This makes it possible to try out a system twice, as well as to provide a basis for comparing equipment. It is further suggested that a company's own personnel learn the operation of the equipment during testing runs. This training proves invaluable when an organization decides to use the new system. It also allows the personnel to determine if the equipment performs as advertised. It is advisable however to verify all claims. They should be checked against the experience of others. One should appraise, evaluate, and pin down the features: speed, flexibility, capacity, ease of programming, reliability, accuracy, degree of utilization, ease of maintenance, kind of tape, cost of supplies, and number of operating personnel.

Knowledge of Programming

A detailed feasibility study develops a knowledge of programming. If a computer is involved, this includes block programming the new system and testing it on the equipment of one or more manufacturer, including trial operation. This should be done before the study group prepares its report to management.

Electronic computers make computations with lightning speed. They have vast memory potential and reach logical decisions. However, computers cannot *yet* think. They must be minutely instructed in coded language as to what information to accept, where to obtain it, how to use it, and what to do with the result. The preparation of these instructions requires programming. This procedure is easier now because of automatic programming sub-routines which have been developed.

Before evaluating and selecting an electronic data processing system, an experiment with an actual application should be tried. There are two approaches to testing an application. First, the computer manufacturer's staff can program it. Second, the study group should learn enough about the subject to program the application. The latter course is better although it takes more time. It is naturally important for company personnel to become familiar with programming techniques. It enables an organization, through its own personnel, to gain an insight into electronic data handling prior to a company's committing itself to a contract for a computer or prior even to signing a letter of intent. A training plan to learn programming includes:

1. Determination of the general construction of the computer, its calculating components, input and output components, storage devices, general knowledge as to a construction, self-checking facilities, etc.
2. Learning the program instruction codes.

The Human Factor

One may well ask at this point about the human equation; as to how the clerical staff will react to the thought of being replaced by automation. This problem has given little trouble in the past in companies that have automated, where an intelligent approach has been made along the following lines:

1. An educational program has been instituted at the beginning of the feasibility study, to convince office workers that
   (a) they will be upgraded rather than downgraded or displaced. The extent of such a program depends upon the attitude of the personnel and has had to be extensive in some cases.
   (b) the new jobs which will be created will be more interesting than the dull, drab routine of present repetitive drudgery.
2. This program must be implemented with actual proof of the above truisms as the feasibility study progresses by retraining those whose jobs will be eliminated in the new system.

Normal job turnover has usually taken care of any total reduction of personnel, but this problem is becoming increasingly important because of the growth of labor unions among the white collar workers. Normal attrition may not be the entire solution.

The feasibility study must be conducted properly, and the many pitfalls encountered by the early pioneers can be avoided by taking advantage of experience gained in the last few years. **s/p/a**

Twenty Tips for Issuing a Procedures Manual

Nations have their constitutions and codes . . . .
Management has its procedures manuals.

Maurice F. Ronayne

► If an employee instinctively feels that he can do a better job than you when it comes to putting out a procedures manual, don't feel bad about it. It's just human nature. The most important advice that can be given to a man who must issue a procedures manual is that he should expect criticism. In fact, he should hope to get it. Constructive criticism is one of the best ways to improve a manual. Many people talk freely on the subject of how to improve a procedures manual but only a few come up with concrete ideas. The following are concrete suggestions, based on the writer's experience:

• *1. Evaluate Criticism*

The man who wants to do a better job, and who always wants to produce a better procedures manual, must develop the ability to spot wheat from plain chaff. Often a suggestion for doing a procedure differently is more valuable if it comes from a clerk close to the actual work than from a member of top management who knows policy only. People who have to use a manual daily to do their work are the best possible source of suggestions on how it can be improved. First-line supervisors, chief clerks, and foremen can also be excellent constructive critics.

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• 2. Get Top Support

Even though top management does not bother to read the detailed procedures of a manual, its support is a "must" if employees are to follow the procedures at all.

• 3. Get Acceptance

Everyone will not follow a procedures manual. Some employees develop their own work methods unless they are discouraged from doing so. Use audit team reports, "on sight" surveys, inter-office correspondence, and "snafus" to find deviations from procedures prescribed in a manual. When found, do your best to get the one responsible for the digression to see that it does not happen again. Emphasize that procedures, once established and *approved*, must not be deviated from. The procedures writer must be alert to the fact that human beings tend to personalize things, even standard operating procedures. Spot these differences. Find the best way to control them. If not controlled, the value of a procedures manual is minimized.

• 4. Use Simple English

The idealistic goals of a procedures writer should be that everyone in the organization understand what he has written and closely follow the procedures. In practice this is not the case. Some people do not understand simple English and others just don't care. Fortunately, however, most employees are cooperative and try to do a good job.

Write in such a way that every employee will be able to follow accurately the instructions that apply to his work. Write in a plain but precise style. Make the procedure clear to the "doer" as well as to the manager.

• 5. Use Action Words

Avoid multi-syllable words and passive statements. Action verbs give force to instructions.

• 6. Keep It Simple

Do not cram too many ideas into one paragraph. Use an outline style. Enumerate items so that a glance will show which are important and which are less significant, in a descending order of importance.

• 7. Be Realistic

Some writers use a "playscript" approach where the instructions are brought as close to actual dialogue as possible, as if in everyday conversation.

• 8. First Things First

Organize your subject matter in a logical way with first things coming first. For example, in writing a new procedure, devote paragraphs consecutively to an Introduction, Policy Statement, Definition of Terms, Responsibility Statement, and then to the Procedure itself.

A well-organized, easy-to-read manual is most likely to be read and followed.

• 9. Establish Contact Criteria

What you put into a procedures manual is naturally of first importance. Unless you set up some guidelines for deciding what should or should not be put into a manual, you will find it ballooning into a voluminous, unwieldy book. Few people like to hunt up material in a manual which contains trivial and unnecessary details.

Establish criteria for content as soon as you start a manual. What should it contain? What is its purpose? Here are

three criteria used by a government agency for determining manual content:

(1) Is the procedure *generally applicable?*

(2) Does the procedure possess a *persistent* policy, procedural, or technical content?

(3) Does the instruction possess a *high reference requirement?* (This is perhaps the most important of the three criteria.)

Use these criteria or similar ones as a basis for putting procedures into a manual. In addition, they serve as a basis for explaining to anyone who asks why you did or did not put a certain procedure into a manual. Everyone thinks his job is important. By the same token, he also thinks his procedure is important enough to be put into the manual. Using the criteria mentioned earlier, you can more objectively evaluate a contributor's procedure for inclusion in the manual. At best you will undoubtedly hurt someone's feelings with a refusal. But a reasonable explanation based on objective criteria tends to assuage a contributor's feelings better than a terse "no."

• *10. Get Participation*

In all cases, try to have a contributor write the initial draft of his material. You are then better prepared to cover everything he wants to include.

One important person who can help you expedite a procedure is the secretary of the reviewer. A few pleasant and courteous calls from time to time may encourage her to suggest to the boss that he review the procedure and get it "out of the way."

It is worth the time and effort also to get the approval of the person within whose bailiwick a procedure falls. These "Okays" protect you. No one can claim that *you* dreamed up a procedure when they *participate* in its creation. In this way you get support for your procedure and better assurance that it will be followed.

• *11. Write the Final Copy*

The final copy for a manual should be written by a "manuals" writer. This is done after all the facts have been accumulated and after a preliminary draft, written by the manuals writer, has been approved by the contributor.

It is important that all material used in a procedures manual be written by one person. The style, prose, and organization of facts should be uniform. Within a short time, the reader begins to expect that the procedures will be written in a certain manner. It makes reading easier and increases comprehension when only one person writes a procedures manual.

• *12. Get Necessary Clearances*

Obtaining necessary clearances can be the *bete noire* of a manuals writer. For example, the editor of a manual is trying to meet a deadline while an important procedure is being held for review by an executive. This is very frustrating. Yet approval must be had if a procedure is to receive acceptance and have authority. Obtaining necessary clearances is part of the writer's job. Top executives do not drop everything to review a procedure. Here is one of the places that a procedures writer shows his true mettle.

• *13. Be Patient*

Tools that the writer must have are tact; diplomacy; patience; flexibility; and

firmness, without irritating. A writer should not feel defeated if a procedure is not published by a certain anticipated date.

• *14. Have Something in Reserve*

Have as many irons in the fire as possible. One procedure may be in the process of executive review, a second in the print shop, a third may be in draft form, and a fourth may still be "in the rough" with a department head. Keep several projects going simultaneously.

• *15. Expect Rewrites*

Do not get upset if what you thought was a letter-perfect procedure is returned to you for a rewrite. After all, even though you write a procedure, the department head still must see that it is followed. And he may decide that the policy, procedure, or responsibilities involved should be presented differently. It is his prerogative to determine how a procedure should be presented to his people.

• *16. Admit Mistakes*

Writing and editing a procedures manual is not an easy task. You will make errors ranging from mis-spelling words to leaving out important steps of a procedure. When a mistake is made, acknowledge it and make a correction as soon as possible.

Minimize mistakes as much as possible. Otherwise your manual will lose its integrity for accuracy. After the final draft has been typed, have your typist proof it carefully with another girl. Then read it carefully yourself. Go through the motions of following the instructions as if you were a manual holder who had just received the new release. Follow these suggestions, and you will reduce greatly your chances for making errors.

• *17. Develop a Table of Contents or Index*

Avoid having too many cross references in a manual. They are handy in finding material but a change in one page may require several pen-and-ink changes to other page references scattered throughout the manual. Also, you may overlook changing a page reference, causing some confusion. Overcome the problem by educating the users to rely upon a table of contents or an index for finding an item. Provide both a general index and a forms index. A good forms index gives the exact page where instructions for completing a certain form can be found.

Revising an index is simplified by typing index page references on a series of paper insert slips. Arrange the inserts on a metal panel or a flat surface and photograph. When a change is made, remove the old insert and put a new one in its place. This device eliminates retyping the whole page each time a change is to be made.

For the general index, some items may need to be "referenced" in at least three different ways. Find out from those who use the manual, the words they generally employ when searching for an item. Do not feel discouraged if someone complains that he cannot find an item in your index. It is impossible to please everyone.

• *18. Revise Periodically*

The main sections of a manual have to be revised from time to time. The traditional method for revising pages is to make pen-and-ink insertions on the original master (which should always be kept on file) whenever minor changes are to be made and to retype an entire master for major ones. This practice is not

always too successful. Many holders do not bother to insert the changes and others just forget. Hence, uniformity of manual content is lost which leads to confusion, misinterpretation, and inaccuracy.

One way to minimize pen-and-ink changes is to use a chalky white fluid to blank out the material that is to be deleted and type the new material over it.

To highlight changes on a page, enclose them in brackets or mark with an asterisk. A reader can tell at a glance then where the new material is rather than having to read the entire page.

When the change is a major and lengthy one you may end up with an extra page. For example, a procedure may include pages 1 to 6. Page 4 is retyped but it runs over to another half page. Instead of numbering this page 5 and making pen-and-ink changes on the other pages, make it page 4a. When the whole procedure is revised later the "a" page can be eliminated.

These methods reduce some of the vexing problems which accompany the making of current revisions to procedures manuals.

• *19. Keep Informed*

No field of management remains static. This holds true for manuals too. Keep abreast of the trends in the preparation of manuals. Subscribe to management magazines which carry articles on various phases of writing, duplicating, and editing procedures manuals.

Do not overlook business equipment salesmen. They can be a source of information about developments in this field. They can provide you with tips on how to do your job better. A special file of brochures of business equipment companies dealing with the preparation of printed material is helpful. Some of these booklets not only describe a product but give tips on how better procedures manuals can be published.

• *20. Get Rapport with Your Printer*

Whether you have your manual printed within your own organization or outside, the printer is an important personality in the procedure of preparing a manual. Keep on good terms with him and you get a better product. He can give you hints on how to get better copy or how to produce copy of a size that is easy to read.

Schedule your work so that you can confer with him when he is not rushed with other work. He will appreciate this. Do not cry "wolf" too often. Do not tell him that all of your jobs must be done "yesterday." If you do, an important rush job will not be "rushed."

When you have criticism about a printer's work, see *him*. For example, there may be a reason for poor copy over which he has no control but which the two of you, working together, can solve.

Conclusion

The tips given in this article have been gained from the writer's experience in preparing procedures manuals. Preparing procedures manuals is a job which is not always easy. Nevertheless, it is an important one. Nations have their constitutions and codes of law. Religions have their Bibles and Korans. Management has its procedures manuals. The proper use of these manuals can insure the equitable and uniform application of policy and procedure throughout an entire organization. **s/p/a**

The Role of the Industrial Engineer in Management Systems Work

. . . administration and production are fields with different problems and enviroments.

M. D. Higbee

► Since the days of the Industrial Revolution, management has been striving to increase productivity and to reduce costs. Not until the early 20th century, however, were the means of accomplishing these objectives given real definition and impetus. At that time, "scientific management" or industrial engineering began in industry, principally through motion and time studies which helped greatly to increase productivity.

One of the early and most significant contributions to this new field was made by Frederick Taylor in the late 19th century. Mr. Taylor was foreman of the machine shop of Midvale Steel Company near Philadelphia. Recognizing that the men he supervised were producing only a fraction of what they might, he looked for a way to increase productivity. Thus, he developed a system of time study and a formula for obtaining maximum production. His formula included defining the task, a method for performing the task, and a definite time for carrying it out. This approach has been used in many ways since that time to achieve efficient

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shop operation. Also, it has been applied to office paper work processes with significant results.

A few years after Taylor developed his principles of scientific management, a young building contractor, Frank Gilbreth, began to study applications of scientific management and motion economy. With his wife, Lilian, he made detailed studies of motions and methods and at length developed a micromotion study procedure.

Although the Industrial Engineer's "tools" were applied initially to factory situations, they have since been expanded, refined, and applied to all phases of business, including the office. Today, the principles of scientific management are applied in the office by Administrative Systems groups. Systems work is carried out by Systems Analysts in much the same way as the Industrial Engineer performs his function in the shop. The principles of Industrial Engineering have served as a valuable guide in administrative systems work. Although the techniques used in carrying out the basic principles in both areas are similar, they are not identical.

Function

What then are the similarities and the differences between Industrial Engineering and Administrative Systems Work? Or, what is the role of the Industrial Engineer in systems work? In order to answer these questions, it is necessary to examine the functions of the Industrial Engineer as opposed to those of the Systems Analyst. By isolating the differences and exploring the similarities, a comparison can be made. While searching for ways to make production more efficient, Frederick Taylor introduced some principles of scientific management and developed a method for increased productivity based upon time study techniques. The complementary tool, motion study, was developed by Frank and Lilian Gilbreth and the principles and techniques formulated by these industrial pioneers still form the basis of Industrial Engineering.

Today the Industrial Engineer, although primarily concerned with shop method, has developed new techniques and established methods for using people in the shops to handle them. More recent "tools" such as production control, quality control, tool design, plant layout, and wage incentives have been developed to solve cost problems and to control processes as well as quality in the shop. Ralph Burke, in his book, *Motion & Time Study,* says,

> "Industrial Engineering is concerned with the design, improvement, and installation of integrated systems of men, materials, and equipment, drawing upon specialized knowledge and skills in the mathematical, physical, and social sciences together with the principles and methods of engineering analysis and design, to specify, predict, and evaluate the results to be obtained from such systems."

In general, the Industrial Engineer analyzes production problems to evolve a methods application which will permit the accomplishment of a given task in the least possible time, at the lowest total cost, and with the least effort. His specialty, preparing job breakdowns of manual and machine operations, requires determining a proper sequence of motions which result in the efficient manufacture or construction of a product. This professional is dedicated to exactness. However, although his training and experience stem from the smallest time motion of a machine or operator, his participation often extends to the magnitude of planning an entire factory operation. He may

be concerned with plant layout for the efficient utilization of space and with personnel evaluation allowances for direct production. He may also be concerned with industrial maintenance, shipping and receiving, and with indirect activities associated with plant operations. Many of these functions (and others not mentioned), are drawn together for a single purpose—*cost control* in the shop—which includes evaluation of expenses, materials, and, of course, labor. In fact, the Industrial Engineer has invaded areas which were originally prohibited to him such as production scheduling, inventory and stock control, scrap and salvage, and other areas of indirect factory labor which affect production. No sphere within the framework of "factory services" is today omitted from his observation.

Office Efficiency

During the period of rapid progress and growth in factory improvement, a general movement to improve office efficiency began to stir. Management began to realize that effective office operations were essential further to increase productivity and to reduce costs. Principles of scientific management are as applicable to certain clerical functions as they are to shop operations and must be applied if the office is to keep pace with the shop and managements' needs. Thus, office management borrowed the "tools" of the Industrial Engineer.

At the same time, Systems pioneers, like A. H. Strucker and Frank L. Rowland, advocated improved clerical practices. Several groups organized to contribute to "professionalizing" the status of those who worked at scientifically increasing the effectiveness of the office: National Office Management Association, founded in 1918; The Life Office Management Association and the American Management Association, founded in 1923; the Systems and Procedures Association of America, founded in 1944. The organization of this last Association was an indication that the Systems Analyst was beginning to be recognized in his own right, and that there was a recognized need for common principles and standards within this growing group. Today this Association is international and has a membership of approximately twenty-six hundred. The work of SPA is closely paralleled by that of the American Institute of Industrial Engineers, founded in 1949, which has a present membership of twenty-five hundred.

The greatest impetus to systems analysis came with the end of World War II. By that time Industrial Engineers had moved into the office field, and their principles of time and motion study were expanded to apply to different office operations. Occasionally they engaged in budgetary control, office work measurement, and clerical methods and standards. The trend, however, has been to replace the Industrial Engineers with Systems groups. Today most of the medium and large industrial companies have established Systems groups to handle administrative systems "engineering."

Administrative Systems Engineering

Administrative Systems Analysis studies the causes and solutions of many kinds of administrative problems and establishes new or improved procedures, methods, and oganizational structure. The Systems Analyst, using the scientific approach, identifies specific problems, determines their causes, and provides solutions. The Systems Analyst, like the Industrial Engineer, is concerned with, but not limited to parts; he must also be able

to evaluate and analyze over-all operations. The Systems Analyst must focus attention upon and analyze not only the parts of office operations but broad administrative policy as well. He is concerned with the administrative management concept of operating a business and the establishment of procedures to achieve objectives, over-all as well as specific; long-range as well as short-range.

Both the Systems Analyst and the Industrial Engineer use analytical investigative methods, usually referred to as "the scientific approach." It involves:

1. Defining the problem, including determination of proper scope and level of survey
2. Collecting factual information and supporting data
3. Analyzing and interpreting data by breaking down the functions into smallest practical elements
4. Questioning each step—"How, why, where, when, and who?"
5. Making necessary adjustments or solutions by eliminating, substituting, combining, or simplifying
6. Developing recommendations
7. Selling the proposed recommendations to operating personnel and then up the line to top Management
8. Supervising the system installation to insure the observance of details
9. Following-up on recommendations

The Systems group then, plans and coordinates such programs for the improvement of business administration as:

(1) Systems and procedures surveys and audits

(2) Flow of information processing work

(3) Administrative policy and planning studies

(4) Organization planning; structuring and control

(5) Cost control

(6) Office mechanization

(7) Effective personnel utilization

(8) Work simplification and work measurement covering all clerical and administrative operations

(9) Motion and time studies (including micro-motion studies)

(10) Office layout

(11) Forms control

(12) Records management

(13) Procedures writing and distribution

The Systems Group

Quite often the staff of the Systems group includes an Industrial Engineer. In this instance he is usually identified as a Systems Analyst. The transition into Systems work is not easy for the experienced Industrial Engineer. Although many of the techniques used are familiar to him, the field of application is new. The problems are different from those in manufacturing. Previously, he processed a motor assembly down a conveyor line; now he is asked to design charts and establish procedures for a "receiving report" used from the shipping platform to the accounting department. In production, it was important that each part fit properly into a sequence in order to permit assembly within a specified time allowance. The engineer was limited to a

few job classifications: workers, foremen, and engineers. Instructions for assembly were abbreviated and quickly understood. As a Systems Analyst he must install an operation involving several departments, each with particular needs for information, copies of forms, and personal attention. A simple problem becomes complex and difficult to analyze because of undefined but inter-related activities. More paper work is required. Thus the Industrial Engineer must learn how to use and control *paper work* for effective office operations. In this he finds a new challenge. Instead of planning a production plant to fit a designated operation, he must, in solving the problem, change the inner workings of the present organization or reorganize the existing structure. A transition period is needed for the Industrial Engineer to acclimate himself to the management systems environment just as a similar period would be required if an Administrative Systems Analyst were to be transferred to factory product design and planning.

Today, with increased emphasis on office automation, manpower control, standard cost, and incentive programs, Administrative Systems groups can profit by having an Industrial Engineer as a member of their staff. His talents, as a member of an automation installation team, can be effectively used because he is thoroughly familiar with such causes of waste as, for example, poor space layout. He knows that any layout which allows operators to waste productive time in traveling between work stations or for supplies is expensive; he realizes that wasted time increases unit cost, reduces productivity, and necessitates additional labor. The Industrial Engineer knows how to study the details of motion and can break down its elements so that each step of an operator's activity is controlled. This "know-how" provides a basis for estimating required out-put and personnel. With an Industrial Engineer's help, the tangible accomplishments of automation in an office—effective personnel utilization, rapid and accurate reporting, and increased paper work productivity—can be enhanced.

Procedural Writing

There is one area in administrative systems analysis, in which the Industrial Engineer needs considerable experience, however, and that is procedural and report writing. Procedural and report writing is a field in itself. Industrial Engineers usually submit findings within their own areas, with or without recommendations, in report form. Systems Analysts, on the other hand, conclude most assignments in a written form. Analysts have usually concluded that the most effective way of accomplishing objectives is to communicate findings and recommendations in writing to management personnel in a position to put the recommendations into effect.

Procedures enumerate in detail steps that are necessary to complete an effective office routine. They define, simplify, and standardize the operation. Written procedures assist in establishing cost controls and in defining objectives and policies of management. Procedures are written in a concise and clear style. Wording is selective so that the finished proposal is understandable to operators, supervisors and managers. Once written and established, however, a procedure is still subject to continued analysis. A procedure may be revised or changed to accomplish management objectives more effectively or to incorporate modern office developments.

Summary

An Industrial Engineer and the tools of Industrial Engineering are a definite asset to Administrative Systems Analysis. An Industrial Engineer can become an effective Systems Analyst. There is no justification, however, for assuming that the similarities between the two areas mean their eventual integration. It does not seem likely that the best features of both groups will be combined into a single activity because *administration* and *production* are fields with different problems and environments. There is a need for "engineers" in both fields.

Above and beyond the personal ambitions of the two groups there is common purpose of continuously striving to provide an enterprise with improved methods.

Administrative Systems is a relatively new field. Its true potential has not yet been realized. Today management insists on economy and efficiency in office systems just as it has for the factory. It is just starting to appreciate the gains to be achieved from proper organization control. As yet there is no real standard for pre-determining the long-range effectiveness of objectives outlined by management and established and installed by Systems groups. There is not much correlation between the objectives outlined by one management group and those of another management group.

As progress is made in this field, however, we will undoubtedly develop a method of measuring the potential success of any given individual within administrative systems "engineering" and will achieve some degree of standardization for functions normally assigned to a Systems group. Perhaps we can compare the present status of the Systems group with that of the Controller some years ago when he was evolving from a chief bookkeeper to Controllership status. Today a Controller enjoys a well-defined set of duties and functions and has organizational status consistent with his position.

The Systems group, at the present time, is in that period of its growth where management is beginning to recognize that a new function has come into being; namely, the professional trouble-shooter or management consultant, commonly referred to as the Systems Analyst. As the Systems Analyst becomes recognized he will find his place organizationally as part of the management team. **s/p/a**

"Integrated Data Processing in Canadian National Railways," a booklet available from Canadian National Railways, International Aviation Building, Montreal, Quebec.

Summary description of CNR's approach to IDP using an IBM 650. General data about a payroll application is given. Four additional areas of potential application are noted: (1) Traffic Management, (2) Property Records, (3) Materials, and (4) Manpower.

The article "Electronics—Its Impact on the Systems Profession" by Edmund G. Benser, as published in the November, 1958 issue of the SPA, was an editorial interpretation of a speech delivered by Mr. Benser to the Empire State Chapter. Consequently, any statements therein are not to be construed as verbatim quotes.

Forms—Management Tool—or Paperwork Empire Builder

Should we, systems people, have an elaborate, clerical operative task within our systems empire . . .

Carl E. Osteen

► For months I have given some thought to systems as a profession, with prime consideration to its place in an organization and to its role in the management team. I have thought about a definition of the responsibilities of the systems function and about the extent of those responsibilities. I have chosen one of the traditional systems controls—forms control—as a method of evaluating whether a systems supervisor has a real honest-to-goodness systems approach to the problem, and presumably to all management problems, or whether he is just another glorified staff assistant, a number one target for the axe in shaky economic periods. I pick this particular area for at least three reasons: First, although of relatively less importance than other systems problems, the problem of forms control provides a common meeting ground. Second, it is not uncommon for systems men to spend hours of their productive effort administering forms control programs (files, reorders, inventory control, etc.). Alarmingly, they also spend much of their time discussing and thinking of their systems responsibilities in relatively minor areas of management problems, one of which might be forms control. Third, and perhaps most significant, of the hundreds of students that enter my classes at the Management Institute at New York University, many

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come thinking that forms control, equipment control, and perhaps flow charting and activity analysis charting will complete their systems education.

Forms Control, a Systems Activity

Let us consider forms control then and see if this particular brush of the canvas tells us whether we are looking at it from the management and systems approach or whether we are looking at it as a clerical operative function which must be perpetuated and built into a small empire within the systems department. The thought here is not to remove forms from under the watchful eye of the analyst. The opportunity of looking at requests for new forms (and reports), new equipment, and new personnel (additional personnel), puts a systems man into a position to set the wheels in motion for evaluating for top management all the operations of an enterprise. Forms control is a most important tool of the systems man, and it is upon this very significance that the balance between the systems management and the clerical operative approach hangs. Should we, systems people, have an elaborate, clerical operative task within our systems empire, or should we make our forms program almost completely automatic, retaining only the controls which we feel are necessary? Answering this question, and thereby shedding some light on what kind of systems person one is, can best be done by discussing the major areas of a forms control program and how it *should be* administered in comparison to how many in reality are administered.

Let us begin by admitting that forms should come under some kind of a systems review, and that this review does involve some measure of administrative headaches, paperwork volume, and personnel training and supervision. Any control program would require some degree of these. On the other hand, should we as systems men not make every attempt to set up the necessary controls and then walk away from them just as we do after setting up controls in systems studies in production, sales, inventory, accounts receivable, distribution, etc. In these areas we do not continue after the initial study to follow every production order, customer order, shipment, billing, or bill of lading.

The following remarks presuppose some sophistication in systems and forms work. They also presuppose that the organization has been informed of the forms program and that a brochure, pamphlet, manual, or equivalent, has been distributed to all levels of supervision. Such a publication gives basic rules of design and construction, specifications about paper quality and standard sizes, and information about principal production processes. It may also give at least one dramatic example of how costs can be materially reduced in each of these areas.

Forms Control Targets

Let us now attack some traditional forms control concepts. Perhaps this will provoke some thought which will "needle" us into taking a new look at the systems approach.

Target No. 1. The forms control unit should control all forms, whether they are used daily or monthly, one a month or a thousand a month. No form should be printed or reproduced without first being reviewed by the forms control unit.

A popular term used to describe forms that come into existence without benefit of forms control is "bootleg forms." The connotation of the term itself is suspect, and many articles belabor this situation

in unfriendly terms. I believe that operating personnel should be given the right, within certain limits, to produce their own forms. If informed through a company brochure how to do a good job, if given a framework within which to operate, and if the form does not change an existing system, then let them produce their own forms. They are going to do it anyway, and it is pointless to try to regiment every employee throughout a company on forms or anything else of a relatively minor nature. It is a proven fact that with prohibition there is bound to be bootlegging, so let us acknowledge that fact. The forms control group should be able to spend its time in more profitable areas than, for example, to worry about a spirit master produced in Oshkosh to provide 200 transmittal forms between two cost centers. They might be better off setting up controls on scotch tape.

Should we take time to review every form up for reprint? Suppose there are 4,000 forms in the company. Suppose we are set up on a six-months' reorder basis, which would mean that forms control would be handling some 8,000 transactions a year. A guess is that of these 4,000 forms, 3,600 would not require continuing examination. If the systems group is studying a specific project, and there is a possibility that forms will be changed, it should signal the purchasing department not to process forms in that area without first sending them to forms control, or if there are certain critical forms that require the utmost care in maintaining a current supply, it should control them. The other 3,600 or 90 percent should be put through automatically.

Target No. 2. Set up functional files. Set up separate numerical files.

Generally speaking, the need for an orderly arrangement of forms falls into two categories: First, we must be able to find and compare similar forms when making periodic reviews or when a new form is requested. Second, since the very heart of systems studies concerns itself with paperwork controls, forms files should be available to facilitate a given systems study.

The so-called "functional" file system has been given much publicity as a solution to the forms filing and analysis problem. Other systems in use, for the most part, have less to offer. But, the functional file system, because of its rather involved classification method, its high set-up cost, its need to be administered by specialists, and its suggested records and reports, demands a critical examination.

The functional plan usually classifies files into 150 to 300 subjects, by dictionary definitions; 18 to 20 functions (to report, to record, etc.); and 10 to 20 possible operations within categories (payment of, status of, etc.). Think of the tremendous filing possibilities under a set-up of this type. It is interesting to observe that in the functional part of the file system, about 90 to 95 per cent of the forms fall within three of the functions, which arrangement when based on filing principles, is worthless.

The functional system has other drawbacks. It is difficult enough to file by subject when dealing with 30 or 40 possibilities. When expanded to 100, 200, or 300, the problem is multiplied. Visualize the task of hiring and training a clerk to administer these files and to recognize 250 subjects. One leading forms control supervisor with this type of filing system had to advertise for a forms analyst with the stipulation that he be familiar with the functional system.

The most serious deficiency, however, is the minimum use that the systems

analyst can himself make of the functional file. Within a typical subject index, subjects such as "cash," "deductions," "earnings," "payroll," and "time" are likely to exist. Actual forms in these categories would be "payroll register," "payroll deduction authorizations," "employee earnings records," "payroll analysis report," and "time card." From a systems point of view these *must* all come together for any kind of analysis. Examination of any one of them purely on the basis of its identity as a form can give only the most superficial economies. Furthermore, it would be very dangerous to combine several forms without first getting the background information about differences and about relation to other forms within the same systems cycle. Recognizing subjects in a particular *systems family* from "dictionary" subjects is difficult. For example, an accounts payable check for paying vendors, a payroll check, a check to pay stock dividends, and a check designed by the promotion department for paying premiums to consumers might all be brought together in the functional file. Probably all these checks could be combined into one form, thereby effecting printing savings, if organizational, systems, and management problems could be worked out. From a systems point of view, however, there would probably never be a possibility of combining them, and it would be pointless, at least at this time in our systems thinking, to devote any time to it.

To solve the problem, arrange forms into major *systems families* There should be no more than 50 or 60 classifications, evolving from the 5 major functions of business: accounting, sales, production, services, and top management. "Payroll" would be a typical breakdown of accounting and all forms in the payroll cycle would be in this systems family. One or more of the 50 might require some breakdown but on the average there would be about eighty forms in each family in our 4,000-form company example. Why set up an elaborate and costly file system and be burdened with a tricky clerical training problem without getting maximum systems usage from the file?

Target No. 3. Establish a forms numbering system that will be a case history in itself.

Here is another area where many forms control and systems people spend too much time. It would be interesting to know the number of hours spent by personnel on forms numbering systems (systems which tell *where used, size, name of printer, date of printing, style, special features, whether revised, which revision, identification of divisions, geographical location,* etc.) and countless other magical numbering devices which make the number a procedure in itself. Training a new clerk in the proper assignment of numbers could be an additional unnecessary burden.

A number should be just an identification. Forms should be numbered consecutively from 1. However, if we can provide a number that tells something, without costing in clerical effort or confusion, it might be worthwhile. For example, assign a two-digit number to each *systems family* (which incidentally should be the same first two digits as Standard Procedures in that family). Number each form in that family from 1 up. (and number the Standard Procedures in that family from 1 up). The only reason for even this much detail is in anticipation of some unforeseen management demand for forms reports, lists, etc. Then the numbering system would facilitate sorting and grouping, if put on margin-sort or punched cards.

Target No. 4. Institute requisitioning procedures, maintain perpetual inventory records on forms in supply, charge requisitioning departments, and keep statistical records on number of forms by function.

Visualize the 4,000-forms company again. If each form is withdrawn from stock an average of 5 times per month (many forms can be withdrawn by many departments), we are confronted annually with 240,000 requisitions; 240,000 inventory entries plus updating; 240,000 journal entries; and many times 240,000 in paperwork handling. Forms will not be stolen. Forms will not be sold. Then why account for forms? If the "accounting" system demands that this "accounting" be present,, then change the system. "Hang a bell" on the reorder quantity, label it, or lock the reorder quantity into another room, but do not keep countless records on forms usage. And do not keep any more than the bare minimum of records in the forms control unit, especially those that do relatively little more than provide a pretty, statistical record by function of how many forms are in the company.

A Systems Tool

The form is a potent systems tool. At the same time it can be used cleverly as a means of empire building in paperwork and personnel. After initial successes in any forms program (paper quality standards, proper production methods, etc.) any forms improvements must of necessity be tied closely to the systems function or specific systems study.

Since relatively few forms are touched by systems studies at any given time, most forms should be set-up for reorder on an automatic basis without the forms control unit ever seeing such requests. Of those that are reviewed, only minimum economies can be effected without applying systems analysis techniques. An accounts payable check designed for a typewriter key punch, a questionnaire form designed to force answers into a margin-sort file system, a continuous invoice designed for a stencil label application, a continuous master employee earnings record abandoned for a 25-line printed tabulating card, and an industry-wide adoption of a universal tab card compatible to both major punched card systems, are examples of how a form can become an integral part of a system. Without the benefit of systems analysis along with forms, it is extremely difficult to justify a full-time forms clerk at $4,000 or more salary, especially when it is recognized that in most companies it would take $80,000 in gross sales to pay that salary.

So here is a suggested, simplified forms program:

1. Educate the personnel through a small brochure.
2. Set up control files on a *systems* family idea.
3. Tie the number system (and Standard Procedures) to the *systems families.*
4. Eliminate nearly all of the record keeping within the forms control unit and outside the unit.
5. Establish a "bootleg" forms program.
6. Establish an automatic forms reordering procedure.
7. Keep a follow-up *control;* watch the critical forms.
8. Think of forms as an effective system tool.
9. Hire one good person to administer a 4,000-forms program as a forms AND systems analyst (and if he has to start the program by himself, from scratch, give him two months to do it).

s/p/a

Business Budgeting: A Survey of Management Planning and Control Practices, *published by Controllership Foundation, Inc., Two Park Avenue, New York 16, 363 pp., 1958, $12.50.*

The survey reported in this book is the result of a study covering the planning, controlling, and budgeting practices of 424 leading companies in the United States and Canada. Conducted by Dr. Bernard H. Sord and Glenn A. Welsch of the University of Texas, the study indicates that budgeting is one of the best approaches for obtaining coordination of the various factors of production in the business enterprise.

This book furnishes much interesting information on the manner in which budgeting is being used by both large and small organizations. It should prove of particular interest to those regularly engaged in financial work and planning. Its numerous charts, statistics, and graphs illustrate budgeting practices in current use. Long-range estimates are that budgeting techniques will continue to expand as a tool of management control.

The authors, commenting on the Profit and Loss Budget, state that, "Sales, production, personnel, purchasing, engineering, finance, advertising, accounting, and all other activities should have specific objectives which are consistent with the over-all profit objective of the enterprise. The profit and loss budget is the primary technique used for bringing together and summarizing the revenues, costs, and the residual income. The profit and loss budget may be viewed as the apex of budgeting. It expresses in financial terms the end results of proposed plans. The budget profit and loss statement summarizes in one statement the results of the complete plan of action; it can also be used to test the adequacy or inadequacy of proposed plans." *(Reviewed by Victor Lazzaro.)*

Scientific Programming in Business and Industry, *by Andrew Vazsonyi; John Wiley & Sons, 474 pp., 1958, $13.50.*

Dr. Vazsonyi is a capable mathematician experienced in applying mathematics to management problems and in communicating mathematical ideas to businessmen. This book is written for businessmen who wish an understanding of "Scientific Programming" which will enable them to see where mathematics may be used in their company, to judge the soundness of applications, and to talk intelligently with experts about their problems.

Much of traditional mathematics developed from problems in science and so has appeared obscure and meaningless to non-scientists. New areas of mathematics are now evolving from business-type problems. These areas should be

meaningful to businessmen since mathematics in a way is an extension of common sense. They should be of practical importance, because they should accelerate the development of new and more powerful management methods and techniques.

The first section of *Scientific Programming in Business and Industry,* The Fundamentals, develops the concept of a mathematical model and introduces the idea of mathematical programming. The second section, Mathematical Programming, is devoted to a detailed study of linear, convex, and dynamic programming. The final section, Programming in Production and Inventory Control, begins with the application of statistics to inventory control and concludes with a discussion of production scheduling including the presentation of a general mathematical model.

The author has skillfully blended discussion of business problems and mathematics, proceeding from simple problems and basic concepts to complicated problems and advanced techniques, to give a clear exposition of a complex subject. Instead of giving proofs, principles are carefully explained so that their reasonableness and significance are evident.

There are spots which are obscure and a few others which demand mathematical knowledge beyond that possessed by most readers. However, on the whole, the exposition is clear and straightforward. *(Reviewed by Carl H. Pollmar, Lecturer in Statistics, University of Michigan.)*

The Computer and the Brain, *by John von Neumann, Yale University Press (143 Elm Street, New Haven, Conn.), 82 pp., 1958, $3.00.*

In February, 1957, Dr. John von Neumann, one of the world's great scientists and foremost mathematicians, died at the age of 54. To the practical world Dr. von Neumann left a great legacy of knowledge and progress through his unpublicized work on the Manhattan Project and the Atomic Energy Commission, through his development of the Theory of Games, now an accepted part of the Technique of Operations Research, and through his work at the Institute for Advanced Study on the logical development of electronic computers. In the last-named area, his contribution is probably the greatest made by any one individual.

The invitation to deliver the annual Silliman Lectures at Yale is considered a privilege and an honor by scholars throughout the world. The chapters of *The Computer and the Brain* were prepared by Dr. von Neumann as the Silliman Lectures for 1956. Due to the illness which led to his death, the lectures were never delivered. This book, comprising these lectures, represents the last of his words to be published; fortunately, it is both complete and, like his other writings, of outstanding significance. Fortunately too, the book is completely understandable to the careful lay reader. That this is true is the more remarkable because the book must be regarded as a penetration into the frontier of an area of pure science—the relationship between computing machines and the human functions which they simulate. For all this the book is written in the clearest of language, devoid of the esoteric terminology which so frequently frightens us away from scientific publications; the writing here is at the same time lucid and scientifically exact. This does not mean that *The Computer and the Brain* is an hour's reading. Every page is pregnant with new ideas and new expressions of old ones, but the thinking reader will find ample reward for his efforts. Clearly this is a work of major significance.

The book is divided roughly into two parts in accord with the title. The first half explains electronic computation principles in terms so simple and objective that those of us who teach this subject would do well to study and copy its presentation. In explaining computer functions Dr. von Neumann prepares for the comparison with the human functions which follows.

The second half of the book discusses the human nervous system, its structure (with neurological terms carefully defined), and its logic as a communications system and computation mechanism. Then the two systems, the two "automata" of machine and human, are compared. The differences between the two are as interesting and as significant as the similarities. The book treats of the basic nerve impulse as an electrical phenomenon, recognizing at the same time that there are chemical and mechanical aspects of nervous functions which cannot be evaluated and which might even invalidate much of the comparison drawn. The conclusion is that in addition to its primary digital mode of operation, the brain operates in a statistical mode not comparable to computers—the implication here is that present-day computers may well be a far cry from their descendants.

In creating the electronic computer we have succeeded in simulating some of the functions of the human mind and nervous system (and there is still room to argue that the computer duplicates these). From observation of past progress in the development of computing machinery it seems logical to hypothesize that we will find the future progress of computation outlined in the functioning of the nervous system. Reading Dr. von Neumann's book can introduce the lay person to the logic of computers and of the neurological functions of the human body and, to those with a basic knowledge of computer capabilities and logic, it can suggest an awesome future for computation machines. *(Reviewed by Richard W. Pomeroy, Fairbanks Associates, Inc., Greenwich, Conn.)*

Handbook of Automation, Computation, and Control, *Volume 1, "Control Fundamentals" edited by Eugene Grabbe, Simon Ramo, and Dean E. Wooldridge; John Wiley and Sons, Inc., New York, 1958, $17.00.*

This extensive book is concerned with a consideration of the fundamental theoretical prerequisites for an understanding of control systems, and is part of an ambitious three-volume series under the same editors (Volume 2 is devoted to computers and data processing and Volume 3 to systems and components). Naturally, a book which contains the foundations of such a broad and dynamic field as control systems could not have been the result of the efforts of one writer or even of a small group of writers, so it is not surprising that the book consists of the work of twenty-nine contributors. What is surprising is that the editors could have gathered such an exceptionally qualified group of writers for the task.

The book is divided into five parts. Part A is on general mathematics and contains brief but carefully written chapters on sets and relations, algebraic equations, matrix theory, finite difference equations, differential equations, integral equations, complex variables, operational mathematics, Laplace transforms, conformal mapping, Boolean algebra, probability, and statistics. Each of these chapters is the work of a distinguished mathematician, and each will be useful as a handy summary of basic ideas. Part B is devoted to numerical analysis and contains much valuable material on matrices, matrix

inversion, and the solution of ordinary and partial differential equations. Part C is a broad survey of operations research which, together with a useful bibliography, conveys much information, and Part D is a discussion of information theory, smoothing and filtering, and data transmission. Part E, a broad statement of the methodology and fundamentals of feedback control and systems analysis, concludes the book.

The primary objective of the editors was to gather into one book a wide range of material that would be useful for both reference and study to a broad spectrum of workers in the control systems field. In this reviewer's opinion they have been spectacularly successful. *(Reviewed by W. Allen Spivey, Ph.D., University of Mich.)*

s/p/a

Worth Reading

"Quick Medicine for Your Executive Reading Load," Philip H. Meadings, *Business Horizons,* Spring, 1958.

Techniques for lightening the burden of required business reading are discussed in this article. First, the executive must learn to prune, and prune ruthlessly—by avoiding overlapping material, delegating to responsible subordinates, using the services of experts, and discarding worthless reading matter. Reading speed can be greatly increased through a determined self-improvement programme. To this end, he advises reading as rapidly as comprehension will allow, and by "thought-units." Skimming is a valuable reading device in many instances. The ultimate goal of good reading is the ability to read critically and to improve one's own thinking and writing via reading.

"The Dangers of Social Responsibility," Theodore Levitt, *Harvard Business Review,* September-October, 1958.

Raising a dissenting voice against the increasing calls for business management to forget that they must be businessmen first and to accept more social responsibility, Mr. Levitt, a marketing and economic consultant, writes: " . . . Businessmen complain about legislative and other attacks on aggressive profit seeking but then lamely go forth to slay the dragon with speeches that simply concede business's function to be service . . . the fact is, no matter how much business 'serves,' it will never be enough for its critics . . . . "

"The Case for Written Procedures," John B. McMaster, *Office Executive,* October, 1958.

Provides brief case histories to illustrate three main reasons for written procedures: (1) Re-examination of procedures often occurs as a result of writing, (2) Unnecessary strain among workers is relieved, (3) Employee orientation and training is simplified. Includes twelve brief principles of procedure writing.

"Charting Office Procedures," Task Group, *Office Executive, November,* 1958.

Offers a standard for charting paperwork. Includes definitions of such terms as system, procedure, operation, method, and task. Cites general requirements of flow charts and offers standard symbols.

"Techniques of Measurement," Richard S. Fitts, *Office Executive,* October, 1958.

This article is first of a series on "Principles of Work Measurement." Describes conditions conducive to a successful installation. Discusses the following measurement techniques: (1) Previous production records, (2) Operator self-timing, (3) Stop-or-wrist-watch timing, (4) Motion picture film analysis, (5) Predetermined times, and (6) Work sampling.

"Installation of a Work Measurement Plan and Incentives," Richard S. Fitts, *Office Executive,* November, 1958.

Discusses the following steps in installing work measurement: (1) Sell the idea to the supervisor and people involved, (2) Study methods for possible improvement, (3) Introduce productive records for area, (4) Obtain time elements, (5) Adjust times to set standards, (6) Test run, (7) Instruct people on how to record work data, and (8) Audit and report, Explains six types of incentive plans and objections commonly raised to incentives in the office.

"Why Restrict Integrated Data Processing to Internal Company Routines?" A. G. Mackey, *Office Management,* October, 1958.

Proposes integration of high volume business transactions between customers, suppliers, financial institutions, and other participants in a business process. Considers applications of the idea in a situation where warehouses receive orders from dealers or stores. Explains operation of the Air Transport Association industry specification for a purchase-order administration system. Discusses possible objections to the concept.

"Forms Redesign, Automatic Transmission Speed Work Flow between Plant & Office," A. H. Scott, *Office Management,* October, 1958.

Describes order-invoice procedure of a two-plant company with a headquarters in a third location. Included in the system is a five-part plant order written by teletype and twelve-part invoice and acknowledgment form. A flow chart of the system is shown.

"Why New Computer Coding Techniques May Accelerate Pace of Office Automation," Robert M. Smith, *Office Management,* October, 1958.

Briefly describes Remington Rand's "pseudo-code" for simplified programming. Detailed sub-routines are prepared automatically by a computer for each of thirty "directive" words. Also considers in detail future use of computers in integrating the operations of a business and its possible effect on the office.

"Put 'GO' in Your Procedures," Leslie H. Mathies, *The Office,* October, 1958.

Recommends that procedures be restricted to statements of "who does what" in processing sequence.

Publications referred to above are published as follows:

1. *Business Horizons,* Bureau of Business Research, Indiana University, Bloomington, Indiana.
2. *Harvard Business Review,* Graduate School of Business Administration, Harvard University, Soldiers Field, Boston 63, Mass.
3. *Office Executive,* Journal of the National Office Management Association, Willow Grove, Pa.
4. *Office Management,* Geyer-McAllister Publications, 212 Fifth Avenue, New York 10, New York.
5. *The Office,* Office Publication Co., 232 Madison Ave., New York 16, N.Y. **s/p/a**

A Systems Manager's Opportunity

► The systems and procedures manager has a larger opportunity than almost any other supervisor to extend the scope of his responsibility. This is due partly to the staff nature of his function but, more importantly, to the still limited recognition by management of the many fields of systems development ripe for cultivation.

By turning in a creditable performance on every systems assignment that comes his way, the systems manager can enlarge his prestige and the scope of his practice just like a doctor or a lawyer. Such a course is rarely open to the line supervisor. He cannot enlarge the extent of his present activities in the same way as the systems manager. This state of affairs is of tremendous importance to the systems profession. In the milieu of today's fast-growing and rapidly changing industrial scene, there is almost unlimited opportunity in this still not clearly or uniformly defined field, to carve out a bigger niche for the systems activity.

To say that a weak systems department indicates a weak manager is to ignore some of the factors that may be beyond the power of the best of managers to change. But, one cannot ignore the implication. One of life's strangest phenomena is to observe a systems man trying to shrug off his own responsibility for a procedural or organizational problem that has come to his attention. To the question "Am I involved?" or "Should I do anything about it?" the only answer is a resounding "Yes!" A systems man takes a pretty short view of things if he shirks his responsibilities. Once the systems man starts begging off, he'll be ignored by the people who need his help and could benefit by his efforts. They'll soon relegate the systems man to the limbo of those quasi-useless staff barnacles who cling to the hull of the ship until the next time she goes into dry-dock.

By contrast, the energetic, ambitious systems manager will accept eagerly every opportunity to exert his influence and to build up through good works the prestige of the systems operation in his company. He will usually find a way to sandwich in a lot of "quickie" jobs along the way—between the bigger projects. Such efforts will go far toward creating a favorable atmosphere for a wider acceptance of his program. Then, if his docket becomes swamped, there is a greater likelihood that his need for a larger staff will not go unrecognized.

After all, the systems manager's job is to define the company's organizational functions and to design its procedures to the idealistic point where all questions are automatically answered as soon as they arise. Therefore he should not resent running a sort of question bureau. When all levels of management start calling on him for all kinds of answers, he can feel that he has pretty well established his responsibility as the company's best authority on how things are intended to be done throughout the organization. This is the crowning responsibility which indicates a wide acceptance of the systems concept and a reliance upon the systems manager's role in the scheme of things. (Gibbs Myers, Northern New Jersey Chapter). **s/p/a**

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